Before the
FEDERAL COMMUNICATIONS COMMISSION RECEIVED
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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
Revision of the Commission's Rules	)	
To Ensure Compatibility with	)	CC Docket No. 94-102
Enhanced 911 Emergency	)	
Calling Systems	)	

COMMENTS OF SPRINT SPECTRUM L.P.

In its Order of September 30, 1998, the Federal Communications Commission

sought additional information regarding the compatibility of digital wireless handsets and

TTY devices. Sprint Spectrum L.P. d/b/a Sprint PCS submits the following responses to

the Commission's questions.

I. **What specific actions are being taken by individual carriers to comply with the
    notification requirements outlined in the *E911 Reconsideration Order* (*i.e.*, the
    requirement that carriers "make every reasonable effort to notify current and
    potential subscribers that they will not be able to use TTYs to call 911 with
    digital wireless devices and services")?**

During the June 1998 billing cycle, Sprint PCS provided a detail statement

regarding the incompatibility of TTY devices and digital wireless phones on every bill

issued to its then existing customer base. The first bill received by each new customer

after that date also includes this explanatory language. The language included on the bills

is as follows:

No. of Copies rec'd _O+4_
List ABCDE

ATTENTION TTY USERS

Background

A TTY (also known as a TDD or Text Telephone) is a telecommunications device
that allows people who are deaf, hard of hearing, or have speech or language
disabilities to communicate by telephone. A TTY has a keyboard used to type a

conversation, which then is transmitted as tones over a wired telephone line. The tones are translated to text that appears on a person's TTY screen.

911 and TTY Access Through Wireless Services

Federal law requires the telecommunications industry to provide a way for TTYs to communicate through wireless systems to make 911 calls. Although traditional analog cellular telephones can complete TTY calls, the newer digital wireless phones are not compatible with current TTY technology. Research is being done to improve the ability of digital phones to work reliably with TTYs. The industry is working to resolve this matter by October 1998.

Sprint PCS modified its Internet website to include additional information regarding the provision of 911 services. The following language was added to the Basic 911 web page:

> Please note that digital wireless phones are not compatible with TTY (also known as TDD or Text Telephone) devices for people who are deaf, hard of hearing or have speech or language disabilities.

Sprint PCS modified the packaging of its handsets and the equipment sheets placed in retail outlets to include information regarding the limitations on the digital transmission of TTY signals. The following language has been or is being added to the side of each handset box and equipment sheet:

> Currently, this digital wireless phone is not compatible with TTY (also known as TDD or Text Telephone) devices for the deaf or hard of hearing.

II. Has any carrier been able to meet the October 1, 1998 deadline? If so, what steps has the carrier taken that led to its ability to meet the deadline?

No digital wireless carrier has been able to meet the FCC's deadline of October 1, 1998. No solution currently exists which would permit a digital wireless carrier to interface with a Baudot transmission system within those parameters set by the TTY Forum.

III. For each of the digital technologies (*i.e.*, TDMA, CDMA, GSM, and iDEN), have manufacturers been able to determine the root technical causes for the incompatibility between TTY devices and their systems? If so, what is the nature of these root technical causes, for each technology?

Sprint PCS uses a Code Division Multiple Access technology to provide its 100% digital nationwide wireless service. CDMA is one of the most advanced systems for the transmission of wireless digital information. It provides more efficient spectrum usage and security by using the entire bandwidth to transmit messages rather than dividing spectrum into discrete call paths. Under this system, handsets are not programmed to read a single narrow transmission. Instead, the handset reads all messages transmitted over a relatively large range of spectrum and applies a complex algorithm to determine which digits are intended for that particular handset.

In order for this system to function efficiently, the relative strength of the transmissions between each handset and the base station must be monitored closely. Accordingly, the base station provides continuous instructions to the handset to control the power of the signal strength. This "Closed Loop Power Control" will increase or decrease the transmission power of the handset to maintain a 1% Frame Error Rate ("FER"). Although a 1% FER is acceptable for standard voice traffic, a greater level of distortion occurs in Baudot signaling due to its slow transmission rate. One TTY character spans 9 CDMA frames.

The source of these character error rates was initially discovered by Lucent Technologies during the testing of its CDMA switches. Those tests suggested that the Closed Loop Power Control's 1% FER would result in a Baudot character error rate of 8.8%. Sprint PCS subsequently tested this theory in its own labs and confirmed an error

rate of approximately 8.8%. Although vocoder issues may also create transmission errors, the majority of the transmission problems in the CDMA network appear to stem from the Closed Loop Power Control.

Because the Closed Loop Power Control is a crucial element of the CDMA voice network, Sprint PCS is aware of no short term solution which would permit a TTY to operate over the CDMA voice network without an error rate of approximately 8.8%. At this time the TTY Forum has indicated that an error rate of 8.8% is unacceptable.

Even if an 8.8% error rate were deemed acceptable, Sprint PCS would be required to develop a cable interface which would permit the transmission of TTY signals between the wireless handset and the TTY device. Because the TTY Forum has rejected any solution which does not have a less than 1% error rate, Sprint PCS has not begun development of a cable interface.

At this time, the only solution which appears to meet the error rates requested by the TTY Forum is a data transmission solution. By permitting messages to be packetized, prioritized and resent when an error occurs in transmission, a data network can provide a much higher standard for the transmission of Baudot signals.

IV. What potential solutions have been submitted to appropriate standard-setting bodies or forums for their review and analysis?

Sprint PCS is aware of no short term solution which has been submitted to a standard-setting body at this time. Sprint PCS understands that numerous potential long term solutions have been submitted to the standards groups for review and evaluation.

V. Are there any segments of the wireless industry that might be crucial to the development of the potential solutions that are not represented in the Forum, *e.g.*, manufacturers of Internet Working Functions (IWF), who would have to modify IWF software as part of a "data" solution) and is their representation necessary for implementation of such solutions?

IWF manufacturers will be instrumental in the development of a V.18 capable modem. Undoubtedly, their participation in standards bodies and wireless technology groups will be indispensable to the timely implementation of a data solution. Sprint PCS does not believe, however, that the participation of these manufacturers is required at the TTY Forum.

VI. Explain the possible negative consequences of any potential solutions for TTY users, *e.g.*, the reduction in throughput that would result from the insertion of additional bits between transmitted characters.

Transmission rates should be minimally effected by a data solution. However, other shortcomings may exist. For example, transmission of location information and selective routing information may pose difficulties for a solution which routes traffic through a centralized modem bank. In addition, it will probably not be possible to change transmission from data to voice and back again in the middle of call transmission, as has been requested by the Consumer Group. Because the data and voice sides of the network operate independently, a TTY will not be able to toggle between the two during transmission of a call. Finally, the data solution will require that the TTY receiving the wireless signal be equipped with an RJ-11 jack.

VII. For each of the digital technologies, what would be the timetable for implementation of a "data" solution on an equitable basis with voice services offered?

The data solution envisioned by Sprint PCS depends upon the development of several components. First, the launch of an underlying data network. Second, the

development of an intelligent interface device between the handset and the TTY device.

Third, the development and implementation of a modem upgrade to incorporate the V.18

standard. Fourth, modification of current switching software to permit the combination

of cell location information with the 911 data call transmission for selective routing

purposes. Each of these steps will have its own development timeline which is dependent

upon numerous factors outside the control of Sprint PCS. Full implementation, even

with an aggressive development schedule, is unlikely to occur in less than 18 to 24

months.

The first and most basic element of a data solution is the launch of an underlying

data network. Sprint PCS has been working towards the development of data capacity

for the past three years. This work is expected to culminate in the phased launch of a

data network beginning in the first quarter of 1999 with nationwide coverage by the

fourth quarter of 1999. Although Sprint PCS expects no delays in the implementation of

this service, the complexity of the undertaking does not permit a firm timeline.

During this same period, Sprint PCS will be required to develop an intelligent

cable which will interface between the TTY device and the wireless handset. This cable

will be capable of converting Baudot signaling to ASCII and ASCII to Baudot. Sprint

PCS has discussed the development of this cable interface with at least one manufacturer

and believes that a workable device could be in production by the second or third quarter

of 1999. The cost of developing this interface is expected to exceed $750,000.00.

The third element of a data solution will be a modem upgrade within the IWF

network to incorporate the V.18 transmission standard. Although the intelligent interface

cable will permit the wireless handset to communicate with the TTY device, the IWF

network will not be able to communicate with the Public Safety Answering Points until the IWF modem banks have incorporated the V.18 standard which converts the data stream to a Baudot signal. Given the current tight time frames for launching the basic data network, upgrades to the modem banks to incorporate the V.18 standard are expected to take a minimum of one year from the time the upgrade is requested and may take substantially longer.

Finally, to complete the provision of voice grade 911 service, Sprint PCS's switches will need to be reprogrammed to address the routing of a 911 call which must first pass through the data network. When a 911 data call is transmitted through the network, cell site information is stripped from the call. The current switching system must be modified to permit the cell location information to be rejoined to the call path once it has passed through the IWF. How this will be accomplished is not clear at this time. The earliest date at which such reprogramming could be accomplished would be the first quarter of the year 2000 and again could take much longer.

Based upon the best information available today, Sprint PCS believes that a functioning data solution for TTY devices could be available by the first or second quarter of the year 2000.

VIII. If an extension were granted in order to reach a long-term solution to the problem of incompatibility between TTY devices and various digital systems, what could each carrier do in the interim to accommodate TTY users on wireless systems?

TTY users will continue to be able to use analog services during the development of a digital system. Sprint PCS offers dual band handsets which could be programmed to operate in the analog mode, thus allowing TTY users to make mobile 911 calls until a

digital solution is completed. Although a cable interface will need to be developed to permit this solution, this type of cable could be developed in a relatively short time frame.

Sprint PCS could also develop a cable interface which would permit the TTY user to communicate in a digital mode over the standard Sprint PCS voice network. The development of this cable could also be completed in a relatively short time frame. The TTY user, however, will still face a character error rate of approximately 8.8%. This error rate may require that a message be transmitted more than once during the course of a phone call.

IX. At what laboratory location will the upcoming testing of digital wireless phones be conducted? Will carriers ensure that representatives from all Forum member groups participate in the testing?

Sprint PCS believes that it is impractical to attempt to test all types of equipment and systems in a single laboratory. Sprint PCS has its own laboratory facilities which simulate Sprint PCS's actual wireless network. A uniform testing protocol should be sufficient to ensure the reliability of these tests. Sprint PCS has developed and submitted a proposed testing protocol to the CDG working group for approval.

X. Will field tests be conducted, including tests involving actual TTY users, following completion of the laboratory tests?

Sprint PCS will comply with the uniform testing plan as required by the FCC. Sprint PCS will conduct field testing to the extent required by the uniform testing plan and to the extent it is technically feasible.

XI. Have carriers provided equipment and wireless service to TTY users so that users can conduct their own field tests? If equipment and service have not been provided, what obstacles have prevented carriers from doing so? What are the carrier's plans for providing equipment and service to facilitate future field tests by TTY users?

Sprint PCS understands that service and equipment has been offered to TTY users for testing.

CONCLUSION

No short term solution currently exists which will permit a TTY device to communicate over a CDMA digital network. After extensive investigation, Sprint PCS has determined that the Closed Loop Power Control will not permit the use of Baudot signaling over the standard voice network. The only technically feasible solution available at this time appears to be data based. The development of this data based solution will require 18 to 24 months.

Respectfully submitted,

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